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Introduction

From the black puff of smoke from an old diesel bus to the haze that obscures the view in our national parks, particle pollution affects us all. This complex pollutant is present year-round, both in our cities and in the countryside, and it can cause health problems for millions of Americans.

EPA's national air quality standards for particle pollution are designed to protect public health and the environment. As this report shows, we are seeing progress: levels of particle pollution are decreasing on a national scale. Yet millions of people still live in areas of the country where particle pollution levels exceed national air quality standards. This harmful pollution affects not only people, but also visibility, ecosystems, and man-made materials.

EPA considers fine particle pollution its most pressing air quality problem, and the Agency is taking a number of steps that will reduce particle emissions and formation. These efforts range from EPA's Acid Rain program and regulations reducing emissions from fuels and diesel engines, to implementation of the Agency's first fine particle standards and a proposed rule to reduce particle-forming emissions from power plants.

In this report, EPA

- Explores characteristics of particle pollution in the United States
- Analyzes particle pollution for 2003 (the most recent year of data)
- Summarizes recent and long-term trends
- Investigates the relationship between air quality and emissions
- Reviews some current programs and future prospects for reducing particle pollution levels.

In addition, text boxes in this report present information on more specialized areas of interest, such as the PM Supersite project, episodic events, satellite monitoring, and the relationship of particle pollution to other air pollutants.

Major Findings

Air Quality Improvements

- Particulate matter (PM) air quality has been improving nationwide, both for $PM_{2.5}$ and PM_{10}.
- $PM_{2.5}$ concentrations
  - in 2003 were the lowest since nationwide monitoring began in 1999
  - have decreased 10% since 1999
  - are about 30% lower than EPA estimates they were 25 years ago.
- PM_{10} concentrations
  - in 2003 were the second lowest since nationwide monitoring began in 1988
  - have declined 7% since 1999
  - have declined 31% since 1988.
- In 2003, 62 million people lived in 97 U.S. counties with monitors showing particle pollution levels higher than the $PM_{2.5}$ air quality standards, the PM_{10} standards, or both.
- Monitored levels of both $PM_{2.5}$ and PM_{10} generally decreased the most in areas with the highest concentrations. For example, $PM_{2.5}$ levels decreased 20% in the Southeast from 1999 to 2003. The Northwest showed a 39% decrease in PM_{10} levels from 1988 to 2003.

Sources and Emissions

- Sulfates, nitrates, and carbon compounds are the major constituents of fine particle pollution. Sulfates and nitrates form from atmospheric transformation of sulfur dioxide and nitrogen oxide gases. Carbon compounds can be directly emitted, or they can form in the atmosphere from organic vapors.
- Approximately one-third of the $PM_{2.5}$ improvement observed in the eastern half of the country can be attributed to reduced sulfates; a large portion of the remaining $PM_{2.5}$ improvement is attributable to reductions in carbon-containing particles, especially in the Industrial Midwest and the Southeast.
- Power plant emissions of sulfur dioxide dropped 33% from 1990 to 2003, largely as a result of EPA's Acid Rain program. These reductions yielded significant regional reductions in sulfate concentrations, reducing acid deposition and improving visibility.
- Nationwide, reductions in industrial and highway vehicle emissions of fine particles and volatile organic compounds appear to have contributed to the improvement in $PM_{2.5}$.
- In the eastern half of the country
  - regional pollution accounts for more than half of the measured $PM_{2.5}$. This regional pollution comes from a variety of sources, including power plants, and can be transported hundreds of miles.
  - sulfates account for 25% to 55% of $PM_{2.5}$ levels. Sulfate levels are similar in urban and nearby rural areas. Power plants are the largest contributor to this sulfate formation.
- In the Industrial Midwest, Northeast, and southern California, nitrates make up a large portion of $PM_{2.5}$, especially in winter. Average nitrate concentrations in urban areas are generally higher than nearby rural levels. Power plants and highway vehicle emissions are large contributors to nitrate formation.
- EPA and states have put in place a number of control programs that will continue to reduce particle-forming emissions. EPA's 2004 Clean Air Nonroad Diesel Rule will significantly reduce emissions from nonroad diesel equipment across the country. EPA's proposed Clean Air Interstate Rule (proposed December 2003) will reduce PM-forming emissions from power plants in the eastern United States.